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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/055,270	01/22/2002	Jae-Hyun Joo	9898-217	6757

7590

04/14/2003

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EXAMINER

MAI, ANH D

ART UNIT

PAPER NUMBER

2814

DATE MAILED: 04/14/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/055,270

Applicant(s)

JOO ET AL.

Examiner

Anh D. Mai

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 January 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,2,4,6-15,17-21 and 24-32 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,2,4,6-15,17-21 and 24-32 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on March 5, 2003 has been entered.

Amendment

2. Amendment filed January 21, 2003 has been entered as Paper No. 6. Claims 3 and 23 have been canceled. Claims 1, 2, 4, 7, 8, 13, 14, 18, 20, 24, 25 and 31 have been amended. Claims 1, 2, 4, 6-15, 17-21 and 24-32 are pending.

Claim Objections

3. Claim 20 is objected to because of the following informalities:

Line 4 recites: "to a pre-annealing form removing carbon", the correct term should be -- to a pre-annealing **for** removing carbon --.

Appropriate correction is required.

4. Claim 21 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form.

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Claim 20, lines 5-6, recites: wherein the pre-annealing is a treatment exposing the lower electrode under plasma atmosphere.

As amended, claim 21 is now broader than claim 20.

Response to Amendment

5. The amendment filed January 21, 2003 is objected to under 35 U.S.C. 132 because it introduces new matter into the disclosure. 35 U.S.C. 132 states that no amendment shall introduce new matter into the disclosure of the invention. The added material which is not supported by the original disclosure is as follows: “subject the lower electrode to pre-annealing for removing carbon remaining in the lower electrode” ; “the crystallization annealing is lower than an inherent temperature of crystallization annealing of said capacitor dielectric layer” ; “the pre-annealing is performed at a range of between 350 ~ 750 °C, and the materiality and surface form of the lower electrode does not substantially change be the pre-annealing” and “the inherent crystallizing temperature of the tantalum oxide layer is over 700 °C”.

Applicant is required to cancel the new matter in the reply to this Office Action.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

6. Claims 1, 2, 4, 6-15, 17-21 and 24-32 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to

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reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

There does not appear to be a written description of the claim limitations “subject the lower electrode to pre-annealing for removing carbon remaining in the lower electrode” (claims 1, 13 and 20) ; “the crystallization annealing is lower than an inherent temperature of crystallization annealing of said capacitor dielectric layer” (claims 7, 18, 24 and 25) ; “the pre-annealing is performed at a range of between 350 ~ 750 °C, and the materiality and surface form of the lower electrode does not substantially change be the pre-annealing” (claim 20) and “the inherent crystallizing temperature of the tantalum oxide layer is over 700 °C” (claim 25) in the application as filed.

The specification does not provide support for any of the identified matters.

At best, the specification discloses: “pre-annealing does not make any substantially change in the materiality of the ruthenium layer. Therefore, the pre-annealing enhances the characteristic of the surface of the lower electrode without any substantial change in the materiality of the lower electrode. As described above, according to the present invention, the impurities, which are induced by the incomplete decomposition of the metal organic compound source, can be removed from the surface of the lower electrode by the pre-annealing”. (page 11, lines 23-29).

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claims 7, 18, 21 and 24-29 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

With respect to claim 7, claim 7 recites: “subjecting the capacitor dielectric layer to a crystallization annealing, wherein a temperature of the crystallization annealing is lower than an inherent temperature of crystallization annealing of said capacitor dielectric layer”.

How can an annealing temperature being lower than itself ?

Claims 18, 24 and 25 recite similar matter.

With respect to claim 21, a broad range or limitation together with a narrow range or limitation that falls within the broad range or limitation (in the same claim) is considered indefinite, since the resulting claim does not clearly set forth the metes and bounds of the patent protection desired. Note the explanation given by the Board of Patent Appeals and Interferences in *Ex parte Wu*, 10 USPQ2d 2031, 2033 (Bd. Pat. App. & Inter. 1989), as to where broad language is followed by “such as” and then narrow language. The Board stated that this can render a claim indefinite by raising a question or doubt as to whether the feature introduced by such language is (a) merely exemplary of the remainder of the claim, and therefore not required, or (b) a required feature of the claims. Note also, for example, the decisions of *Ex parte Steigewald*, 131 USPQ 74 (Bd. App. 1961); *Ex parte Hall*, 83 USPQ 38 (Bd. App. 1948); and *Ex parte Hasche*, 86 USPQ 481 (Bd. App. 1949). In the present instance, claim 21 recites the broad recitation “wherein the pre-annealing is **one selected from the group consisting of** a thermal annealing under a selected atmosphere and a treatment exposing the lower electrode under a

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plasma atmosphere”, and the claim also recites “wherein the pre-annealing is a treatment exposing the lower electrode under plasma atmosphere” which is the narrower statement of the range/limitation.

Since claim 21 is indefinite, thus, claims 24-29, which depend on claim 21, are indefinite for the same reason.

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

8. Claims 1, 2, 4, 6-15, 17-20 and 30-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Agarwal et al. (U.S. Pub No. 2002/0037630) of record in view of Applicant admitted prior art.

With respect to claims 1 and 13, as best understood by the examiner, Agarwal teaches a method of fabricating a semiconductor device as claimed including:

forming a lower electrode (12) on a substrate (10) using a CVD process;

subjecting the lower electrode (12) to a pre-annealing, wherein the pre-annealing is a thermal annealing under a selected atmosphere;

forming a capacitor dielectric layer (28) on the pre-annealed lower electrode (12), wherein the capacitor dielectric layer (28) is formed of a crystallized material; and

forming an upper electrode (30) on the capacitor dielectric layer (28), wherein the lower electrode (12) is formed of metal. (See Figs. 1-7).

Thus, Agarwal is shown to teach all the features of the claim with the exception of explicitly disclosing the CVD process using a source having carbon.

However, the admitted prior art teaches that it is conventional in the art to form a lower electrode by a CVD process using a source having carbon.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to form the lower electrode (12) of Agarwal by a CVD process using a source having carbon as taught by the admitted prior art because the layer formed is more conformable to step differences of the underlaid structure. (See page 2, lines 10-16).

With respect to claims 2 and 14, the lower electrode (12) of Agarwal is formed of a material selected from the group consisting of a ruthenium.

With respect to claims 4 and 15, a metal organic material of the admitted prior art is used a source having carbon for the CVD method (MOCVD).

With respect to claims 6 and 17, the pre-annealing of Agarwal does not substantially change the materiality of the lower electrode (12).

With respect to claims 7 and 18, as best understood by the examiner, the step of forming a capacitor dielectric layer (28) of Agarwal includes:

depositing a capacitor dielectric layer on the pre-annealed lower electrode (12); and
subjecting the capacitor dielectric layer (28) to a crystallization annealing.

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With respect to claims 8 and 31, the pre-annealing of Agarwal is performed at a temperature that overlaps the claimed range.

With respect to claims 9 and 19, the selected atmosphere or plasma atmosphere of Agarwal comprises hydrogen gas.

With respect to claim 10, the selected atmosphere of Agarwal comprises nitrogen gas.

With respect to claims 11 and 12, the selected atmosphere of Agarwal is a mixed atmosphere comprises hydrogen and nitrogen.

With respect to claims 30 and 32, Agarwal teaches subjecting the metal lower electrode (12) to a pre-annealing in selected atmosphere comprises hydrogen gas (reducing ambient) at a temperature that higher than the claimed range. The claimed temperature range does not appear to be critical.

However, Agarwal also teaches that the temperature required for the pre-annealing process may be reduced if reducing ambient is used.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to reduce the pre-annealing temperature of Agarwal since the reducing ambient is used.

Further, within purview of one having ordinary skill in the art at the time of invention, it would have been obvious to determine the optimum pre-annealing temperature in reducing ambient to treat the lower electrode. See *In re Aller, Lacey and Hall* (10 USPQ 233-237) "It is not inventive to discover optimum or workable ranges by routine experimentation".

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With respect to claim 20, as best understood by the examiner, Agarwal teaches a method of fabricating a semiconductor device as claimed including:

forming a lower electrode (12) on a substrate (10), by a CVD method;

subjecting the lower electrode (12) to a pre-annealing, wherein the pre-annealing is a treatment exposing the lower electrode under plasma atmosphere;

depositing a tantalum oxide layer (28) on the pre-annealed lower electrode (12);

crystallizing the tantalum oxide layer (28); and

forming an upper electrode (30) on the capacitor dielectric layer (28), wherein the lower electrode is formed of metal, the pre-annealing is performed at a range of temperature, and the materiality of the lower electrode does not substantially change by the pre-annealing.. (See Figs. 1-7).

With respect to a CVD method using source having carbon, a similar reason as that of claims 1 and 13 is also applied here.

With respect to the pre-annealing temperature, the pre-annealing temperature of Agarwal is overlapped the claimed range.

Response to Arguments

9. Applicant's arguments with respect to pending claims have been considered but are moot in view of the new ground(s) of rejection.

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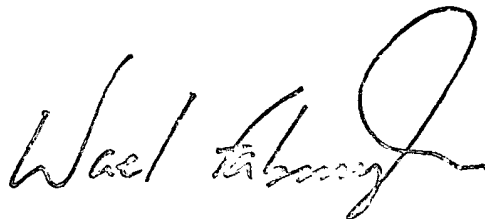
Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anh D. Mai whose telephone number is (703) 305-0575. The examiner can normally be reached on 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on (703) 306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

A.M
April 9, 2003

A handwritten signature in black ink, appearing to read 'Wael Elbany', is written over a light gray grid background.

SUPERVISORY PRIMARY EXAMINER
TECHNOLOGY CENTER 2800